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Coexistence of Guided Mode Resonance and Extraordinary Optical Transmission in metal/dielectric/metal Photonic Crystal Slab

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Abstract

This study examines the optical properties of metal-dielectric-metal (MDM) photonic crystal slabs (PCS) which consist of a 100-nm freestanding silicon nitride membrane that is sandwiched on either side by a 20-nm-thick gold film with an array of hexagonal tapered holes. It shows the extraordinary optical transmission phenomenon that is generated from the coupling of internal surface plasmon polaritons that are excited by dual gold layers. In addition, the presence of transmission dips can be attributed to the guided mode resonance of silicon nitride based PCS. Numerical calculation of photonic band structure confirms this attribution. This coexistence of extraordinary optical transmission and the guided mode resonance in MDM PCS may contribute to the development of multifunctional optical devices.